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HIGHLIGHTS

THE 1963 FEDERAL BUDGET
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FEDERAL BUDGET DIGEST

The Federal Government expects to finance over two-thirds of the nation's research and development activities during the fiscal year which ends June 30, 1963. Private industry is expected to finance most of the remaining national R&D effort, with smaller amounts provided from funds of foundations, educational institutions, and by state and local governments.

Net budget spending for Federal R&D programs is estimated at $12,365 million during Fiscal 1963 compared with $10,244 in 1962 and $9,291 in 1961. The 1963 total includes $889 million for R&D facilities, with the remainder for conduct of R&D.

The totals do not include routine testing, experimental production, information activities or training programs. Of the total Federal R&D expenditures, about two-thirds are made through contracts with private industry; over 10 percent through grants and contracts with universities and other non-profit institutions; and the remainder by Government scientists in Federal facilities.

How is the money allocated between Government Agencies and Programs?

Department of Defense spends the largest share. Actual expenditures for R&D including facilities will rise to about $7,167 million as compared with some $6,500 in 1962. National Aeronautics and Space Administration (NASA) expects to spend some $2,400 million in 1963 for R&D including facilities, almost $1 billion more than in 1962. Actual authority to obligate new funds for this booming agency comes to some $3,733 million.

Basic Research expenditures for all Government agencies, within the totals above, will increase to about $1.6 billion in 1963, as compared with "well over" $1 billion in 1962. A major share of this increase is attributable to the NASA, where costly programs involving space satellites and probes of a non-applied nature are included as basic research.

Education, much of it included under R&D funding, represents another rising trend. Expenditures for education programs by all Federal agencies are estimated to be $1.5 billion in 1963, an increase of $327 million over 1962. Here again the actual trend of spending is much higher, since "new obligational authority" requested in the Budget actually totals $2.4 billion -- an increase of more than $1 billion in a year.

The Kennedy Administration has indicated that changes may be made in the Budget as the year progresses, but there appears to be less inclination for Congress to alter technical programs this year than there has been in the past.

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* SPECIAL FIELDS OF R&D EMPHASIS:

Once again, a number of agencies will receive additional funds for special fields of R&D emphasis including oceanography, atmospheric sciences, high and low energy physics, and materials and water research. Details of these and other programs may also be found in various Agency sections of this Special Digest:

□ Oceanography -- The Government's breakdown of this field of research totals $123.6 million in new spending authority (obligations) compared with $101 million in 1962 and $62.1 million in 1961. An estimated $53.1 million for research and instrumentation will provide for studies by the Navy particularly of the physical and chemical properties of the sea; grants of the National Science Foundation for oceanography including marine biology; the work of the AEC related principally to radiation and atomic wastes; and research by the Department of the Interior on commercial fish resources. Survey programs to map and provide basic statistics on depths, currents, temperatures and related data will total $17.1 million. Funds for the construction of ships and facilities will total $49.1 million. Also included is $3.7 million for forthcoming International Indian Ocean Expedition and $.6 million for the National Oceanographic Data Center in Washington.

□ Atmospheric Sciences -- The atmospheric sciences are undergoing rapid development as an increasing array of new techniques become available to obtain and process data bearing on atmospheric properties estimated to grow to over $200 million in 1963, roughly double the past year's effort. Almost one-half of the increase in 1963 is being directed to the meteorological and scientific satellite programs of the National Aeronautics and Space Administration. Other increases have been required by the rigorous needs of new defense programs, detection and prediction of radioactive fallout, air pollution, and aviation and air-traffic control as well as the desire to advance the science generally through basic research grants and facilities. A notable step to be taken in 1963 will be the financing by the National Science Foundation of a major construction and operating program for the National Center for Atmospheric Research.

□ High and Low Energy Physics -- High energy physics is concerned with the study of elementary particles at the subatomic level and related nuclear forces. It is characterized by high costs for high energy particle accelerators and related equipment. In 1963, total Federal expenditures for high energy physics research and construction are estimated to be $138 million -- of which the Atomic Energy Commission's share is $126 million -- as compared with a total of $109 million in 1962 and $86 million in 1961. The balance is chiefly accounted for by the Department of Defense and the National Science Foundation.

Low energy physics is concerned with the structure and properties of the nucleus of the atom and the character of related nuclear processes. The research is conducted primarily with particles produced from relatively small accelerator and research reactors. Total Federal expenditures for low energy physics in 1963 are estimated at $61 million -- of which Atomic Energy Commission will provide $40 million and the National Science Foundation $14 million -- as compared with a total of $52 million in 1962 and $39 million in 1961. The balance is chiefly accounted for by the Departments of Defense and Commerce.

□ Materials Research -- Attention has been given over the past 2 years to strengthening materials research with emphasis on basic research and related graduate education. While no overall figures are available, basic materials research is being given increased support particularly through Federal financing of interdisciplinary materials research laboratories on a number of major campuses.

□ Water Research -- A long range study of future needs for research in natural resources has been initiated by this administration. Particular attention has been given in recent months to Federal programs in water research. While no precise estimates are available, this budget provides for a significant strengthening of several agency programs in water research particularly in the Department of the Interior.

* Atomic Energy Commission

Funds for the Atomic Energy Commission increase somewhat this year, primarily for weapons and space-related research. This includes weapons production and development, rocket propulsion reactors, satellite and small power sources, as well as general reactor technology, nuclear safety, high energy physics, nuclear structure and neutron physics, chemical properties and reactions and somatic effects of radiation. These increases will be partially offset by reductions elsewhere, principally in the procurement of uranium concentrates.

✓ Reactors -- There is a big AEC "0" in 1963 for the long controversial atomic airplane project, and no important changes in civilian and military reactor programs. Spending on the Project Pluto ramjet missile propulsion reactor program is just a bit ahead of 1962. The major increases are in the AEC's Project Rover rocket propulsion reactor program, up from $43.4 million to $74.8 million and in Project SNAP for satellite and small power sources, up from $50.1 million to almost $72 million. In SNAP, a new program will be launched to develop a high power system for application to large communications satellites, reconnaissance systems, and space probes. This program will use basically the technology to be developed from the high-temperature lithium-cooled reactor experiment.

The Administration states that the development of civilian atomic power will be carried forward at about the levels attained in 1962. The view is that "Atomic fuels offer a valuable supplement for conventional fuels in the short term and an essential replacement for them in the much longer term. Numerous large power reactors have been and are being constructed, for which valuable technical information will be obtained. Expenditures for the development of civilian atomic power and directly related supporting technology will considerably exceed $200 million in 1963.

✓ Physical Research will increase from $176 million to $216 million as new accelerators are put into operation. An increase for other physics and mathematics research provides for several low energy physics accelerators on university campuses and an expanded research program in this field. There will be some increase in chemistry and metallurgical research to include operation of unspecified "large research tools" and some additional new projects. Project Sherwood, directed toward ultimate production of power from the controlled fusion of heavy hydrogen nuclei, continues at present levels. About 74 percent of the physical research program is conducted at 13 laboratories owned by or operated for AEC, with the remainder, comprising some 570 projects, supported at more than 150 colleges, universities, institutes and independent laboratories.

✓ Weapons -- Spending will increase from about $630 million to $742 million for the production of weapons; the maintenance of stockpiled weapons in a state of constant readiness; the design, development and testing of new weapons types; and the development of test detection methods. President Kennedy is also requesting Congress to authorize spending some $139 million in new and transferred funds for the current fiscal year "in order to meet the needs of the weapons program."

✓ Facilities -- Requirements in 1963 include some $31.7 million for new projects relating principally to research and development test plants for project Rover, modification to existing reactors, housing and plant modifications for a lithium-cooled reactor experiment and calcined waste storage tanks. Large physical research facilities include construction and modification of ultra-high energy particle accelerators in the multibillion volt range. There will be various new laboratory buildings and $112 million to provide additional funding for projects previously authorized by Congress, including the Stanford linear electron accelerator, a transuranium processing plant, a zero gradient synchotron and modifications to other accelerators. No major changes appear to be contemplated for other aspects of the AEC program, including training and fellowship, isotope developments or Project Plowshare for the peaceful exploitation of nuclear explosions.

* BUREAU OF MINES

Increases here will go for a variety of projects including an oil shale study to determine the composition of various products, to test the applicability of those products to different uses, and to determine the basic chemistry and physics of the refining process. Metallurgical research will concentrate on improved processes for extracting metals and non-metals from their ores and adapting them for efficient use. Multi-discipline investigations are planned, particularly for super-pure materials. In mining research, attempts are made to applying physics as a scientific discipline in concert with mining engineering principles. One of the most important problems to be attached is that of stabilizing underground openings and techniques for designing efficient open-pit slopes.

Funds are also requested for plans and specifications for the relocation of research facilities from Pittsburgh, Pa. to Bruceton, Pa. and for the establishment of a new Bureau Research Center at Frederick, Md.

Authority is being requested for stepping up helium acquisition payments from the present limit of $47.5 million per year to $65 million. Additional borrowing authority of $20 million is requested for 1963. During 1963 a Government-owned and operated pipeline system will be built to transport helium from industry's plants to underground storage near Amarillo, Tex. Private industry will be financing, constructing and operating plants for recovery of helium now going to fuel markets as a noncombustible component of some natural gases. The Bureau believes that up to 12 new plants will be needed; contracts have been entered into with four companies to date.

* OFFICE OF SALINE WATER

New spending authority (obligations) increase from $5.2 million to $7.7 million for this program to finance research for conversion of saline water to fresh water in quantities sufficient for municipal, industrial and agricultural use. In 1963, three demonstration plants will be operated by the Government for a full year, and two plants for part of the year. Funds are included for construction of new plants at Roswell, New Mexico and Wrightsville Beach, North Carolina.

* NATIONAL BUREAU OF STANDARDS

A healthy increase here -- up approximately $6 million to the $30 million level to finance the expansion of selected research programs and procurement of scientific equipment and facilities. Emphasis will be placed on standards for radio and microwave quantities, measurement and standards problems in plasma physics and astrophysics and high-temperature standards and measurement methods. Work in chemistry and metallurgy will emphasize studies of the fundamental properties of materials under varying environmental conditions, and on the preparation and analysis of high-purity substances. Other programs include studies of the engineering properties of materials at extremely high and low temperatures; basic research on upper atmosphere physics; theoretical and experimental research on plasma physics and astrophysics. Construction funds include a plasma physics building, a radio warning service building, a radio standards laboratory, a $150,000 grazing incidence vacuum spectrograph; a $150,000 mobile very low frequency receiving facility.

* U. S. WEATHER BUREAU

Funds are increased here for an expanded level of ocean-atmosphere studies, for purchase of two research aircraft and rental of an ultra high speed electronic computer. The Weather Bureau's share of U. S. space spending involves purchase of 4 Nimbus spacecraft, and will require in 1963, $39.7 million of capital outlay, $3.7 million of operating costs, and additional contracting. The worldwide meteorological satellite program is expected to begin operating in 1964. A large share of the funds to be available will be spent on data acquisition and processing, and communications.

* NATIONAL SCIENCE FOUNDATION

An increase of almost $95 million in new spending authority is requested, for a total of about $358 million. Grants for support of "basic research and facilities" will expand nearly 42 percent, according to the Administration. The programs in "support of science education" will increase over 25 percent. Much of the Foundation's increase, however, appears to be centered in "hardware" and "brick and mortar" programs reflecting expenses for facilities at educational and other non-profit institutions in such fields as astronomy, oceanography, electronic computation, and the biological sciences; for so-called "national research centers" for the atmospheric sciences, astronomy and radio astronomy and for field programs such as Antarctic research, the "Mohole" program for deep crustal studies of the Earth, and the International Indian Ocean Expedition. In addition, the Foundation is planning to increase its program of matching grants for the modernization of graduate laboratories at universities. The number of grants for support of research projects, on the other hand, increases but slightly -- from 2,450 to 3,200 and the number of fellowships for advanced study in science and mathematics shows an even smaller increase -- from 4,439 to 4,872. Although the NSF traditionally deals with non-classified programs it makes less program detail available in the new Budget document than the Army, as an example, makes available on its stewardship of the Ryukyu islands.

* U. S. GEOLOGICAL SURVEY

Increases here include a proposed new program in marine geology and hydrology as part of the national oceanographic program. Research would be designed to acquire knowledge of the characteristics of mineral deposits in the sea, the hydrodynamics of coastal aquifiers, the composition of the Continental Shelves and suboceanic crust, and geochemical physical processes that determine the fate of pollutants discharged from the continents. Another program calls for establishment of hydrologic benchmark areas in which the quantity, quality and other properties of surface and ground water will be observed under conditions where man's activities have had little effect.

✓ Water Institute -- This agency also proposes to establish an Institute of Water Research to improve capabilities for analyzing and solving water problems. The Institute would have three major functions: (1) Research in fundamental hydrology; (2) Research of a clinical nature applied to specific basins and hydrologic systems which can be used as type examples for the development of principles and methods of analysis of complex water situations; (3) Research to develop a "bridge of theory" between principles of hydrology on the one hand, and socio-economic factors on the other. The Institute would carry out its functions through theoretical studies; through field and laboratory research by members of its staff and visiting scientists from other Federal agencies; through arrangements with universities and other non-Governmental research organizations; and through analysis of knowledge available from the worldwide scientific community.

* COAST AND GEODETIC SURVEY

Increase for 1963 are primarily to support an expanded role in oceanography, increased requirements for aeronautical charts, geodetic and geophysical surveys, improvement of ship base facilities -- and expansion of basic and applied research in oceanography, geodesy, geomagnetism, seismology, cartography, photogrammetry, gravimetry, astronautics and related fields.

* BUREAU OF THE CENSUS

This Bureau requests some $4.1 million in new spending authority to replace obsolescent equipment and provide more electronic computing facilities. During 1963 a large-scale computer will be installed.

SPACE SPENDING

Everyone in the U. S. might as well enjoy the space race, since everyone will be helping to pay the bills. The estimate is that "new obligational authority" in this field will come to some $5.5 billion in 1963 -- and we're just getting started. What's more this total does not include such expenses as the development of military missiles which are also used in space programs, military personnel costs involved in the space effort, and "various other operating costs" which could involve millions more.

Mr. Kennedy, speaking of space programs, states:

"Last year, I proposed and the Congress agreed that this Nation should embark on a greater effort to explore and make use of the space environment. This greater effort will result in increased expenditures in 1962 and 1963 combined, of about $1.1 billion above what they would have been under the policies of the preceding Administration; measured in terms of new obligational authority, the increase is $2.4 billion for the 2 years. With this increase in funds there has been a major step-up in the programs of the National Aeronautics and Space Administration in such fields as communications and meteorology and in the most dramatic effort of all -- mastery of space symbolized by an attempt to send a man to the moon and safely back to earth.

"Action is being taken to develop the complex Apollo spacecraft in which the manned lunar flights will be made, and to develop the large rockets required to boost the spacecraft to the moon. The techniques of manned space flight, particularly those of long-term flight and of rendezvous between two spacecraft in earth orbit, are being studied both in ground research and in new flight programs.

"Our space program has far broader significance however, than the achievement of manned space flight. The research effort connected with the space program -- and particularly the tremendous technological advances necessary to permit space flight -- will have great impact in increasing the rate of technical progress throughout the economy."

FEDERAL SPACE PROGRAMS

(New Obligational Authority Programs in millions of dollars)

Agency	1961 actual	1962 estimate	1963 estimate
National Aeronautics & Space Administration.	926.2	1,786.3	3,732.9
Department of Defense.....	793.8	1,147.2	1,517.7
Atomic Energy Commission.....	63.2	120.1	192.9
Department of Commerce: Weather Bureau.....	-----	50.2	47.2
National Science Foundation.....	.6	1.6	1.7
Total.....	1,783.8	3,105.4	5,492.4

MANNED SPACE FLIGHT

□ Spacecraft Development and Operations -- Steps are being taken this year to initiate the advanced programs for manned exploration of space which will lead to extended manned earth orbital flights, manned circumlunar flight and a manned lunar landing and return within this decade. In 1963 expanded effort will be devoted to the two methods now under consideration to achieve a manned lunar landing -- direct ascent from the earth to the moon, most likely with the use of a huge Nova launch vehicle, and the use of rendezvous techniques to bring large spacecraft together in an earth orbit, after which the combined spacecraft would continue to the moon, most likely with the use of Saturn-type vehicles.

* SPACE SPENDING (Continued)

Major emphasis will be placed in 1963 on the development of a Gemini two-man spacecraft to test rendezvous technology, and of the three-man Apollo spacecraft which will be used for manned lunar flight with either the rendezvous or direct ascent method. Apollo spending authority in the new Budget is placed at about $617 million; Gemini at about $203 million. The total recommended new obligational authority for manned space flight, including these two projects, comes to $2,260 million.

✓ Launch Vehicle Development -- This is very much a "liquid" program, much to the distress of solid propellant advocates who turn up with less than $8 million in new spending authority, compared with $81 million for the new M-1 liquid engine alone.

Background: In both 1961 and 1962 major emphasis was on the Saturn launch vehicle, the first stage of which was successfully launched in October, 1961. The Saturn, with 1.5 million pounds of thrust in the first stage will be used primarily to launch large spacecraft into Earth orbit. There is some $249 million in the Budget for the Saturn C-1. The so-called Advanced Saturn, which has some $385 million in new authority for 1962-1963, will generate a total of about 7 million pounds of thrust in the first stage and will be used for manned circumlunar flights and to boost the components of the Apollo spacecraft to a rendezvous in earth orbit from which manned lunar landings may be developed. The Budget allocation for liquid propulsion engines also includes $55 million for the F-1 engine, about $39 million for the J-2 engine and $14 million for analysis and experimental development on a variety of projects.

✓ Nova program represents a major budget decision for the Kennedy Administration. This huge launch vehicle, with at least 12 million pounds thrust in the first stage will receive its first major funding in the 1963 budget -- a figure of $164 million exclusive of engine development. NASA says that Nova could be used to place 300 to 350 thousand pounds in a low earth orbit, or "in any event" would be used in missions "beyond the moon" even if there is a decision to employ rendezvous techniques, and an Advanced Saturn, for lunar missions. A Nova first and second stage contract will be let within the current fiscal year, chiefly for design, development and perhaps the start of fabrication.

✓ Nova engines will also be a costly part of the space program. The first stage of the Nova would consist of eight clustered F-1 engines, currently under development by North American Aviation, Inc. A new M-1 engine would be used as a "building block" for upper stages. This will be a liquid hydrogen-oxygen engine of roughly 1 to 1.2 million pounds thrust. According to present plans, the Nova second stage would use four such engines, and the third stage would use one. Development of the M-1 engine calls for some $55 million in the new 1962-1963 Budget program, and a contract for this project would be let "within two weeks -- hopefully."

✓ Solid Propellant Engines have obviously won few enthusiasts within the NASA. The $8 million in the space agency's budget for this purpose is to be supplemented by about $40 million in the Defense Department, plus some funds for solid propellant rockets to be attached to the Titan ICBM for the Dynasoar program and perhaps other space work. NASA states that previous efforts by the Defense Department to develop a solid fuel booster as a "back-up" for the manned lunar program have not been "abandoned" but will be on a "slightly longer timescale." Dr. Hugh Dryden, Deputy Administrator, NASA, states that "It is quite obvious from the studies we have made of the program, that you could not possibly approach the time scales of the liquids, certainly with rendezvous." In addition, Dr. Dryden refers to the Titan modified with attached solid propellants (Titan III) in these terms: "We have not stated any requirement. We have no programs tied to Titan III. In the first place, we don't know what the time schedule is. We can't plan the program unless you know when you are going to have it and what it will do."

* SPACE SPENDING (Continued)

✓ Other Launch Systems -- The Budget allocates $8.9 million to the Scout program with emphasis on increasing the payload from 150 to about 240 pounds through an improved first and upper stages. The Centaur vehicle carries $75.7 million in new allocations, about $9 million more than in the last Budget. The sounding rocket program will increase by some $5 million to about $19 million, primarily as a means of increasing university participation in space science and as a means of flight-testing new instruments. Substantial additional funds are allocated for other means of propulsion including Project Rover, a nuclear rocket, and nuclear electric power systems under Project SNAP. Effort will also be devoted to the development of small solid rockets for use in space vehicles, electrical propulsion systems, and battery, solar and other electrical auxuliary power units used to operate sensors and telemetry equipment in spacecraft. Nuclear systems technology receives a $123 million allocation; electric propulsion some $30.6 million and general space power technology some $20 million.

✓ Unmanned Spacecraft development includes $175 million in scientific satellites and $274 million in lunar and planetary exploration. Major emphasis will be devoted to earth orbiting geophysical, astronomical and solar observatories. Work on cooperative international scientific satellites will also be expanded. In the unmanned lunar exploration programs, the emphasis in 1963 will be on the Ranger and Surveyor programs to land scientific instruments on the lunar surface and to collect detailed data from lunar orbiting spacecraft in support of the manned lunar landing program. Actual design studies on both Prospect and Voyager programs are included. Development of the Mariner series designed to explore the planets Venus and Mars will continue.

✓ Space Applications include both meteorological and communication satellite systems. The meteorological program is shared by both NASA and the Weather Bureau, with some $98 million allocated for 1963 on top of $104 million in 1962. Further details may be found under Weather Bureau. Communication satellite spending is going up to $85 million in 1963 on top of some $48 million in 1962. In the passive communications satellite program, work will continue in 1963 on the advanced Rebound satellite to follow the "highly successful" Echo program. In the field of active communications satellites, emphasis is aimed at early availability of operational communications satellite systems. Major projects will include the Relay wide-band experimental satellites being developed by RCA, and the Syncom twenty-four hour satellite system being developed by Hughes Aircraft for NASA and the Defense Department. NASA states that "Technological developments from the government research programs in the communications satellite area are being made available to encourage the earliest possible use by industry. In addition, NASA will provide services on a reimbursable basis to firms which wish to launch privately developed communications spacecraft such as the AT&T Telestar to be launched in 1962. NASA will also initiate effort on advanced satellites of the intermediate altitude and "twenty-four hour" type.

✓ Space facilities comprise some $818 million in the Budget. These include facilities for propulsion development, spacecraft development, ground testing and launching required primarily to carry out the various programs. Major items include Advanced Saturn and Nova launch and support facilities at Cape Canaveral; associated ground test and support facilities at Huntsville, Ala. and the new Mississippi Test Facility, Pearl River, Miss.; additional propulsion development and manufacturing facilities at the Michoud Plant, La. and at contractors' plants; and development facilities for the Apollo spacecraft at the Manned Spacecraft Center, Houston, Tex. An applied sciences laboratory for communications and meteorological satellites is proposed for Greenbelt, Md.; a biosciences laboratory at Ames Research Center, Calif.; spacecraft environmental simulation facilities at Greenbelt, Md.; flight simulator at Edwards Air Force Base, Calif.; a new data acquisition facility in the Far East and at various U. S. locations; an advanced antenna System at the Goldstone, Ariz. station and additional antenna facilities at Johannesburg, South Africa and Woomera, Australia.

DEPARTMENT OF DEFENSE

Changes in the Budget format this year make it particularly difficult to summarize or analyze the Defense Budget. Each program is listed and described under four or more different types of accounts; details are vague through accident or design and for the first time in memory the formal Budget Document of almost 1200 pages had "no room" for a breakdown by individual service, such as Army, Navy or Air Force for many items. In addition, Defense Department officials concede that under the new system (which has many advantages) they can give no estimate of how much will actually be spent for anything in 1963.

Totals are provided for so-called "new obligational authority" in the Budget, just as they are for other Government agencies. However, these totals may be most misleading when attempts are made to analyze trends, since many programs have a good deal of obligational authority left over from previous years. For example, funds approved by Congress for an additional B-52 wing last year will be spent for this purpose, leaving many millions for bookkeeping and program shifts, which may or may not show up until Defense programs are subjected to detailed Congressional scrutiny.

With this in mind, some of the major actions disclosed by the Defense Department include:

✓ No production or even long-lead time procurement for the Nike Zeus anti-missile program because of unspecified "system limitations" which have not yet been overcome.
✓ No speedup in the B-70 program beyond the present prototype program. No provision for a complete "weapon system", no production or deployment funds.
✓ A procurement decision on the air-launched Skybolt missile, which will be carried by the B-52 and can be launched some 950 miles from a ground target.
✓ A step-up in the Minuteman program for a total of 800 missiles by Fiscal 1963.
✓ Start of work on a new mobile, intermediate range ballistic missile.

Defense Research and Development

Here is summary of information on military research and development as presented by Defense Secretary Robert S. McNamara before the Senate Committee on Armed Services, on Friday, January 19, 1962:

"✓ BASIC RESEARCH -- This area includes all exploratory type effort in the physical, environmental, mathematical, psychological, social, and medical science fields. A steadily increasing amount of funds has been devoted to basic research over the last several years. For fiscal year 1963 we are proposing $191 million for this particular area of research, about $20 million more than fiscal year 1962. The funds proposed for the coming fiscal year will continue approximately the same over-all level of effort provided for 1962 since increasing costs for both scientific personnel and the more complex and costly research equipment required will tend to absorb a substantial portion of the additional funds provided for fiscal year 1963.

✓ APPLIED RESEARCH -- Included in this area of research are programs which apply presently available scientific knowledge to the solution of military problems. In effect, these programs bridge the gap between basic research and development of particular weapon systems. They include research in such fields as fuels, explosives, power sources, weather phenomena, communications, navigation, and components for aircraft, guided missiles and space systems. Also included in this category is most of the effort of the Advanced Research Projects Agency (ARPA).

Propellant Chemistry -- This project is devoted chiefly to increasing substantially the specific impulse of fuels used in missiles. Major emphasis has been placed on the laboratory synthesis of new families of chemicals, including both solids and liquids, which show potential as propellant fuels or oxidizers. An increase of almost $5 million to a level of $23 million is requested for this program in FY 1963.

Project Defender -- ARPA's Project DEFENDER is a program of research aimed at providing the basis for future systems of defense against ballistic missiles. We propose to continue the DEFENDER program at $110 million in 1963 - about the 1962 level. The large initial investment costs associated with the measurement of missile phenomena have already been funded, for the most part, but funds will be devoted in 1963 to a continuation of work in this field and to the analysis and evaluation of data collected from previous experiments. Emphasis will also be placed on the development of measurement devices and measurement experiments looking toward the definition of a weapons system concept.

Project Vela -- Also in ARPA is Project VELA, the national program for developing a capability to detect nuclear explosions underground and at high altitudes. The major effort to date has been devoted to underground test detection techniques. As a part of the seismological research program, a world-wide network of standardized seismographs is being installed with the cooperation of a large number of research stations in many countries. In addition, a prototype network of stations specifically for detecting, identifying, and locating underground nuclear detonations is being constructed and is expected to be fully operational in FY 1963.

During the current series of nuclear explosions at the Nevada Test Site, sensing equipment is being emplaced at a wide range of distances from the center of the explosions to obtain data to improve techniques for the detection and identification of nuclear explosions. An underground nuclear explosion in an active seismic area and one or more nuclear explosions in large underground cavities will also be required to provide additional data for the verification of existing theories.

The high altitude test detection program consists of ground-based instrumentation for detecting light emitted from detonations, changes in the atmosphere induced by the radiation or debris from a detonation, and for detecting electromagnetic waves produced by nuclear detonations. With regard to space-based detection, instrumented low altitude flights of the DISCOVERER satellite series and an environmental test satellite program will be essentially completed by the end of fiscal year 1962. During fiscal years 1963 and 1964, a number of fully-instrumented launches using the ATLAS-CENTAUR booster will be conducted. Existing launch facilities and ground support equipment, as well as tracking and data acquisition stations, will be utilized. $63 million is requested in the Defense budget for Project VELA in fiscal year 1963, compared with $60 million in 1962.

Other ARPA Projects -- Command and Control Research, Materials Sciences, Weather Physics, Energy Conversion, and Technical Studies are other areas in which ARPA is doing work in support of its activities and those of the Director of Defense Research and Engineering - either because of their inter-service scope, or to provide centralized direction.

✓ ADVANCED TECHNOLOGY AND EXPLORATORY DEVELOPMENTS -- The efforts included in this category are a step closer to the final development of usable military end-items and are directed toward the solution of specific military problems.

Army -- Army projects in this area include work on improved radar.

Navy -- Navy programs include improvements to the reliability and operational performance of existing radar, radio equipment, missiles, and aircraft, as well as the development of new components and techniques for surveillance, command and control, weapons, aircraft, ships and submarines, logistics and other naval applications. Forty-five percent of the work being done in the Navy's ASW R&D program falls under the heading of Advanced Technology and Exploratory Developments. Also included within this field are projects for sea area surveillance capability; Project TRIDENT; hydrofoil applications; nuclear propulsion; radar surveillance techniques; communications experiments such as LOFTI (the VLF satellite); surface, subsurface and airborne sonar techniques employed for the detection, classification and localization of submarines; mines; development of an ASW aircraft engine; and numerous other programs.

✓ Air Force -- The first item is the Very Large Solid Rocket Motor for which $50 million was appropriated last year in the RDT&E account to initiate work. We are requesting additional funds for 1963 to continue this effort. You may recall that this project was designed as a backup for the NASA manned lunar landing program as well as to develop the capability for large boosters for possible military uses. It provides the fundamental technology on which to base the production of large, solid, first-stage rockets for launch vehicles.

The next item, Space Booster Building Block, involves a modification of the TITAN II ICBM to a TITAN III in order that it may be used along with large solid fuel boosters as well as a variety of upper stages. We visualize this TITAN III standard launch vehicle as a "work-horse" booster to place in orbit a broad range of payloads. Also included is a standardized upper-stage vehicle which will be compatible with the TITAN III configuration, which I just discussed, as well as other primary boosters.

The Aerospace Plane Components project, for which funds are included in the budget, represents a prudent approach to the development of an aerospace plane. What we are attempting to do here is to solve the basic problems first, including the development of the necessary components, before we decide whether to begin the very expensive system development phase of this project. The components might be useful in other applications as well. $10 million is included for the X-15 to continue this highly useful test project.

Funds are included for PLUTO, a nuclear ramjet propulsion system directed toward providing sustained power for a very high speed unmanned vehicle. The military requirement for a system incorporating such an engine has not been fully defined and cannot be until engine characteristics and performance parameters are better determined. This is a joint DOD-AEC program.

✓ NATIONAL RANGES AND MANAGEMENT AND SUPPORT -- The National Ranges are the White Sands, Pacific, and Atlantic Missile Ranges. We are requesting a total of $445 million in 1963 for these ranges - almost 50% more than 1962. The principal increase is in the Atlantic Missile Range, primarily for increased ground instrumentation and instrumented ships. The increased capability is needed, in part, to extend the range coverage for the penetration aids program.

✓ WEAPON DEVELOPMENTS

Army -- We come now to specific weapon developments. The first item in the Army list is NIKE-ZEUS. The amounts requested for 1963 is to continue the evaluation of the tactical configuration of the missile, and for the accelerated development of all the associated ground equipment, radars, computers, data links, and display aids required for the complete system.

Funds are included for MAULER, a ground-to-air missile which will have a range between REDEYE and HAWK and will be a mobile self-propelled system capable of engaging targets, ranging from short range tactical ballistic missiles and rockets to low flying subsonic aircraft. Funds are also included for MISSILE B, which is intended as the eventual replacement for HONEST JOHN and LACROSSE, the Army's present shorter range rockets and missiles. A number of possible approaches are under consideration.

The Heavy Assault Anti-tank Weapon, for which funds are also requested, is designed to provide a significant advance in our capability to detect and kill all known enemy armor at battlefield ranges.

The New Surveillance Aircraft included in the budget is intended as the eventual replacement for the MOHAWK. We intend to explore in this project a number of different configurations, including the work the British are doing in this field, before we commit ourselves to a final design.

Additional funds are requested for the Tri-Service VTOL aircraft, not only in the Army budget but also Navy and Air Force. This project is quite significant from a management point of view, since it represents an attempt to develop an aircraft to meet a mission rather than an individual Service requirement. The objective of this program is to develop two different types of flyable research VTOL aircraft taking advantage of all the various approaches previously made in this area. What we hope to get out of this effort is an aircraft which can take off with a substantial payload from unprepared locations having little or no runway facilities.

Funds are also included for the development of improved switching equipment required for the Army's long haul communications network.

Additional funds are requested for the Army's communications satellite program. This is the principal Department of Defense effort to achieve an operational communications satellite system at an early date. The ultimate objective of this program is to maintain a communications satellite in a 24 hour synchronous orbit; in other words, a satellite which can maintain a constant position relative to the surface of the earth. A system of such satellites would provide a significant element of a highly flexible and dependable world-wide communications network.

Funds are requested for developments involving improvements in our battlefield surveillance capabilities and for studies to determine the characteristics which should be incorporated in the main battle tank of the future.

The total requested for Army weapon development is $892 million.

✓ Navy -- The first system on the Navy list is TYPHON. This is the new missile system being developed for naval ships; it may be the eventual successor for TALOS, TARTAR, and TERRIER. However, the TYPHON system promises to be very expensive and we will want to know considerably more about it before we commit it to production. Meanwhile, as I pointed out earlier in my discussion of the Navy shipbuilding program, new frigates will be designed to accommodate the TYPHON system without any commitment at this time actually to install the system aboard the new ships.

Funds are included for the Navy's all-weather satellite-borne navigation system. This is an extremely accurate navigational system and is expected to be of great value to our POLARIS force as well as other forces requiring precise navigation data.

The development of the Mark 46 Torpedo will be continued. This active-passive acoustic homing torpedo is specifically designed for use against submarines by surface ships and aircraft. It could also serve as a warhead for the ASROC weapon system.

The amounts for Marine Corps R&D covers a wide range of equipment developments such as lightweight long-range early warning radar, amphibious vehicles, tactical data systems, etc. The total requested for Navy Weapon Development is $262 million.

✓ Air Force -- We have again restudied the role of the B-70 in our future strategic retaliatory forces and again have reached the conclusion that the B-70 will not provide enough of an increase in our offensive capabilities to justify its very high cost.

The principal advantage of the B-70 is its ability, in common with other manned bombers, to operate under positive control and to deliver a large number of nuclear weapons in a single sortie. Considering the increasing capabilities of ground-to-air missiles, the speed and altitude of the B-70, in itself, would no longer be a very significant advantage. Furthermore, it has not been designed for the use of air-to-surface missiles such as HOUND DOG or SKYBOLT, and in a low altitude attack, it must fly at subsonic speeds. In addition, the B-70 is not well suited to an era when both sides have large numbers of ICBM's: it would be more vulnerable on the ground than hardened missiles and it does not lend itself to airborne alert measures.

Nevertheless, we plan to complete the limited development program outlined to the Congress last year -- namely, to demonstrate the technical feasibility of the aircraft structure and configuration, as well as certain major subsystems required in a high speed, high altitude environment. This approach would still preserve the option of developing a manned bomber if we should later determine that such a system is required. The total cost of this program is estimated at $1.3 billion. About $800 million was funded through fiscal year 1961, $220 million of the $400 million appropriated by the Congress last year will be applied to 1962 and $171 million to 1963. The balance of the $1.3 billion will be funded in subsequent years.

The Air Force has studied the reorientation of the B-70 to a reconnaissance strike vehicle. Such an aircraft might be useful in providing damage assessment and reconnaissance information for the retargeting of the missile force during the attack period. It would also have a capability to attack previously unlocated, undetected or incompletely destroyed targets. Obviously this proposal will require a great deal more study to determine whether the advantages to be gained from such an aircraft are worth the great costs involved.

We are requesting funds to begin the development of a new Mobile Medium-Range Ballistic Missile. Such a system, when developed, might be deployed on trucks or ships. Essential requirements for this system would be quick reaction times and great accuracy without the need for extensive ground support equipment.

Amounts are requested to continue the program which encompasses the development, testing, launching, tracking and control of large satellite vehicles, and the ejection and recovery of payload capsules from orbit. The results of this program are directly applicable to many of the Air Force space programs and contribute also to NASA space programs.

Additional funds are requested for the early warning satellite program which was discussed in connection with our Continental Air and Missile Defense Forces. This is an early warning system of orbiting satellites designed to detect hostile ICBM's during the launch phase by means of infrared sensors.

Additional amounts are requested for DYNASOAR in 1963. You will recall that the Congress last year added $85 million for this project after we already added $30 million to the original 1962 budget request. After a careful review of this program, we believe that the level of effort we are recommending is all that is required and all that can be effectively utilized. Last month we reoriented the entire program, eliminating the suborbital flight phase which would have involved the use of a modified TITAN II booster.

The total requested for Air Force weapon developments discussed in this section is $1,019 million."

OTHER DEFENSE DEPARTMENT PROGRAMS

✓ B-52 -- The $515 million appropriated last year for an additional wing will not be spent because it would increase the B-52 operational inventory by "only seven percent"; because manned bombers are vulnerable to attack and cannot be held in reserve during a war situation "to be used in a controlled and deliberate way." It costs well over $1 billion to buy a wing of B-52's together with its tankers and Skybolt missiles and to operate it for five years. For the same cost, the U. S. could buy and operate 250 hardened and dispersed Minuteman missiles or 6 Polaris Submarines. The B-52 can carry 4 Skybolt missiles in place of the 2 Hound Dog missiles currently being employed. As Skybolt becomes available DOD will reduce the number of Hound Dog missile squadrons, but increase the number of Hound Dog missiles per squadron.

✓ B-58 -- The planned B-58 force of two wings will be in place by the end of this year. No increase is apparently planned.

✓ KC-135 -- A "sizeable number" of these tanker aircraft will be purchased to support the bomber and tactical forces.

✓ ATLAS - TITAN -- Program calls for completion of the 13-squadron Atlas program and the 12-squadron Titan. As the Minutemen and Polaris forces are built up "it may be desirable later on in the decade to start phasing out some of the soft Atlas."

✓ Mobile Minuteman -- "The benefits to be gained are not worth the cost" because of the "extremely large research and development required." It would be "much more expensive to operate...less reliable and less accurate than the fixed-base version...more susceptible to sabotage and would involve many difficult operational problems such as protection from fallout, safety, etc."

✓ Polaris -- Six more in 1963 and six more in 1964 but that may be all because "it is difficult to justify a Polaris force of more than 41 submarines" when Minuteman and other strategic systems are taken into account. First six Polaris submarines are equipped with the 1200 nautical mile range A-1 missile. The 7th to 19th will have the 1500 mile A-2 version. The 20th and all subsequent submarines will have the 2500-mile A-3. A West Coast Polaris complex will be begun with a $44.5 million allocation.

✓ SAGE Warning System -- "We have examined in the light of current technology the feasibility of hardening SAGE and have reached the conclusion that it is impractical," but all elements of this and other warning systems will be continued. Work will go forward on semi-automatic and manual backup systems for the SAGE "as an alternative means of controlling our air defense weapons in the event that all or most of the SAGE centers are put out of commission."

✓ Manned Interceptors -- No additional procurement of interceptor aircraft is contemplated this year but dispersal will be emphasized.

✓ Bomarc -- "We plan to retain this system in future years."

✓ Nike -- The 19-battalion Ajax version will gradually be phased out. There is $105 million to increase the number of Hercules missiles per battery, and to complete the procurement of new high powered radar and associated equipment.

✓ BMEWS -- The Ballistic Missile Early Warning System is already operational at Clear, Alaska, and Thule, Greenland and a third at Fylindales, United Kingdom will become operational in fiscal 1963. The Thule site is equipped with 4 detection radars and one tracking radar. The Clear site has 3 detection radars. The Flyingdales site is to be equipped with 3 tracking radars.

✓ MIDAS -- The development of a system of orbiting satellites for missile attack warning will be continued. No figures given.

✓ Bomb Alarm System -- This system, now operational, provides automatic detection of nuclear detonations at selected sites. The system is to be refined to provide timely information on fallout data and damage assessment for which more elaborate detection devices will have to be developed.

✓ SPADATS -- Increased funds for the Space Detection and Tracking System will support the development of greatly improved radars, other sensory devices, and computers.

✓ Satellite Inspection -- Additional funds are requested for this program under which a satellite would be placed close to and in the same orbit as an object to be observed, reporting back to the ground station its observation. This was the "Saint" program, now known as "Inspector."

✓ Davy Crockett -- This Army nuclear delivery system receives $12.6 million "to provide a large part of our inventory objective."

✓ Army Electronics -- A $296 million procurement total, including nearly $30 million for the new AN/VRC-12 vehicular radio set and $13 million for the man-portable radio AN/PRC-25.

✓ Army Aircraft -- A 1963 budget of $219 million compared with $248 million for 1962. Includes a number of Caribou twin-engine transport; Iriquois helicopters and the Chinook. An unspecified quantity of observation helicopters will replace older fixed-wing observation craft.

✓ LARC-5 -- A large 1963 procurement is planned for the new 5-ton amphibious lighter.

✓ Air Defense Missiles -- Tentatively, the Redeye man-carried antiaircraft weapon will be placed in production with 1962 funds and another increment for 1963. Hawk procurement "will closely approach the deployment objective."

Sergeant missiles "will completely meet the inventory objective for the approved forces, except for future requirements for training." An unspecified quantity of Pershing missiles will be bought.

✓ Navy Carrier -- A strong backing for aircraft carriers, and one new non-nuclear version because "the operational benefits to be derived from the nuclear-powered carrier, particularly in limited war operations, do not, in our judgement, justify the higher cost." No new ASW carrier construction is planned, but as Essex-class carriers are released from the active carrier force they will replace the older carriers for ASW.

✓ Other Navy Shipbuilding -- No further major modernization of the cruiser force is considered justified and the role of the cruiser in the future "is still under active study, particularly with regard to the construction of new Typhon cruisers. Several mothballed ships will be converted for use as alternative national command posts in the event of nuclear war. A major communications relay ship, delayed in 1962, will be in the 1963 program. Destroyer forces are being reduced. A new nuclear powered guided missile frigate is recommended.

✓ Navy-Marine Aircraft -- Major procurement of the F4H at the same rate for several years. No additional F8U's beyond the 1963 program. A "considerable number" of A4D-5's to be procured "for a number of years." An "urgent" requirement for A3J-3 aircraft configured for reconnaissance missions. Procurement of A2F-1's, with increasing quantities in later years. Procurement of the turbprop P3V-1 will continue for a number of years. Other procurement mentioned includes S2F-3 long-range search aircraft, HSS-2 helicopters, and W2F-1 early warning aircraft.

✓ Navy-Marine Missiles -- The first buy of the Shrike antiradar missiles, and another quantity of Subroc antisubmarine rockets are planned. Target drones and antisubmarine drone helicopters will be purchased. Missile procurement includes Sparrow III, Sidewinder IC, Terrier, Talos, Tartar and the first Navy procurement of Bullpup, for training.

✓ Navy Electronics -- A "modest" increase of about 9 percent over the 1962 program but no details.

✓ Air Force Tactical Aircraft -- "Substantial numbers" of new tactical fighters will be purchased over the next few years. F-105 production will be "gradually tapered off" in favor of the Navy-developed F4H to be known in the Air Force as the F-110. A contractor will be selected "in the very near future" for the TFX which will use a variable geometry wing and will be powered by turbofan engines. Air Force and Navy will use this aircraft for low-level bombing operations, as well as for very high speeds at altitude. Under long-range plans, the F-110 will replace the present tactical reconnaissance force. A reconnaissance version of the TFX will be developed to be available in the late 1960's.

✓ Airlift Aircraft -- There are no so-called "administrative aircraft" purchases in the new Budget, but much is being spent on overseas airlift capabilities. The decision was made to stop procurement of the C-135 aircraft after completing 3 squadrons. A number of C-130 E aircraft will be purchased instead, and emphasis will be placed on the new C-141 which "promises to provide a real breakthrough in airlift performance."

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